INDEX TO VOLUME IV.

OCTOBER, 1892, TO MARCH, 1893.

LEADING ARTICLES.

American Annexation of Hawaii.	*T. Graham Gribble.*	898
American Railway Progress in 1892.	*Thomas L Greene.*	867
America's Need of the Nicaragua Canal.	*Warner Miller.*	799
Anthracite Coal Industry, The. Illustrated.	*H. M. Chance.*	544
Architecture in Wood—a Protest.	*Gordon B. Kimbrough.*	345
Are American Mechanics Boastful?	*T. F. Hagerty.*	443
Benefits of Reciprocity with Canada.	*Erastus Wiman.*	337
Bridge Building in America. Illustrated.	*T. Kennard Thomson.*	16
Building the Cable-Road in New York. Illustrated.	*George Iles.*	351
Business Opportunities in Cuba. Illustrated.	*Eduardo J. Chibas.*	266
Choice of an Architect, The.	*Bernard McEvoy.*	529
City Hall Architecture in America. Illustrated.	*Barr Ferree.*	201
Colonel E. C. Smeed and His Work.	*Herman Haupt.*	115
Copper Region of Michigan, The. Illustrated.	*Frank B. Phelps.*	47
Do We Need a State-Bank Currency?	*Edward Atkinson.*	497
Electric Motor and the Farmer, The.	*William Nelson Black.*	260
Fire Losses and the Age of Clay.	*Harvey B. Chess.*	561
Fire Losses in Fire-Proof Buildings. Illustrated.	*Charles H. Bebb.*	731
Geology and the Mississippi Problem.	*A Southern Engineer.*	536
Glass-Making Industry in America.	*R. M. Atwater.*	883
Gold-Fields of Bendigo, Australia, The. Illustrated.	*J. F. Markes.*	420
Great Wall of China, The.	*John A. Church.*	654
How Electricity is Measured.	*Herbert Laws Webb.*	72
How We Can Guard Against Cholera.	*George F. Shrady.*	64
Industrial Decadence in Germany.	*James C. Bayles.*	38
Industrial Development of the South. Illustrated.	*R. H. Edmonds.* 1, 187, 370, 513	
Interior Fireproof Construction. Illustrated.	*John M. Carrère.*	95
Irrigration Problem in the West, The.	*H. M. Wilson.*	386
Increase of Speed on Railways.	*W. Barnet LeVan.*	845
Is the Climate Changing?	*H. A. Hazen.*	836
Labor Troubles and the Tariff.	*Charles J. Harrah.*	411
Light in Tall Office Buildings.	*Dankmar Adler.*	171
Liquid Fuel in Steam-Making.	*F. R. Hutton.*	591
Locations for the Pig-Iron Industry.	*John Birkinbine.*	858

Mexico as an Iron-Producing Country.	*Robert T. Hill.*	744
Mississippi Problem Up to Date, The.	*William Starling.*	247
Modern Uses of the Windmill. Illustrated by W. Louis Sonntag.	*R. H. Thurston.*	719
Our Costly Geological Survey.		
I. A Glimpse of Its Record.	*E. O. Wolcott.*	221
II. Reasons for Supporting It.	*N. S. Shaler.*	225
Our Outlook for Foreign Markets.	*Albert D. Pentz.*	506
Our Remaining Hard Wood Resources.	*Charles Mohr.*	378
Pan American Railway Surveys, The. Illustrated.	*J. D. Garrison.*	577
Phosphate Industry of Florida, The. Illustrated.	*Floyd B. Wilson.*	80
Practical Farming by Electricity. Illustrated.	*A. F. McKissick.*	708
Practical Value of Long-Distance Telephony.	*Herbert Laws Webb.*	879
Progress in Pneumatic Transmission.	*William Allen Smith.*	677
Progress in the Art of Wood-Working.	*C. R. Tompkins.*	194
Railroad Development in Africa. Illustrated.	*Cyrus C. Adams.*	693
Reciprocity with Canada.	*Erastus Wiman.*	109
Relation of Architect and Engineer, The.	*George Hill.*	808
Relative Cost of Gas and Electricity.	*C. J. Russell Humphreys.*	240
Shall the Professions be Regulated?	*N. S. Shaler.*	9
Ship-Building on the Great Lakes.	*Henry A. Griffin.*	815
State-Owned Railways in Australia. Illustrated.	*Richard Speight.*	661
Timber Problem in the South, The.	*Charles Mohr.*	685
True Cause of Labor Troubles, The. A Reply to Mr. Charles J. Harrah.	*Jno. Gordon Gray.*	569
What Engineering Owes to Chemistry.	*A. L. Griswold.*	233
World's Fair and Industrial Art, The.	*A. T. Goshorn.*	645
World's Fair and the Death Rate, The.	*James C. Bayles.*	434

EDITORIAL DEPARTMENTS.

Electricity.	*Franklin L. Pope.*	119, 285, 452, 600, 754, 906
Mechanics.	*Frederic R. Hutton* and *Leicester Allen.*	125, 291, 457, 605, 759, 911
Architecture.	*Barr Ferree.*	131, 297, 462, 610, 764, 916
Civil Engineering.	*T. Graham Gribble.*	137, 303, 467
Mining and Metallurgy.	*Albert Williams, Jr.*	143, 308, 472, 615, 774, 926
Industrial Chemistry.	*R. A. Witthaus.*	620, 769, 921
Machine-Shop Notes.	*Albert D. Pentz.*	149, 331, 477

ABSOLUTELY Clean Surface for Experiment Unattainable 332
Accidents in German Shops, Decrease of .. 605
Alaska's Mineral Resources..... 618
Alkali Manufacture, Advance in English.. 623
Alloys Formed by Compression, Experiments on 778
Alternating-Current Plants, Efficiency of.. 756
Alternating Currents, Best Frequency for.. 288
Alternating Currents, Two-Phase and Three-Phase.... 124
Alternating Transformers, Efficiency of Modern..... 122
Aluminum at 15 Cents a Pound..... 928
Aluminum in Cast Iron, Effect of... 608
Aluminum, Proposed Names for 314
Amateur Electrical Union 909
Ammonia from Blast-Furnace Gases..... 621
Apprenticeship, Mechanical..... 331
Arc-Light Carbons for Fuel..... 910
Architectural Growth of a City 610
Architectural Journals in England and America..... 917
Architectural Progress in America.... ... 297
Architecture and Landscape Gardening.... 768
Architecture and Sanitation..... 131
Architecture in Relation to Life 132
Architecture, Modern Causes of 916
Architecture, New Departures in 301
Arkansas Zinc Mines..... 619
Armature Winding, New Type of..... 124
Asphaltum Mining..... 777
Auriferous Cement Gravels, Improvement in Treatment of 619
Auroral Currents, Needed Investigation of. 604
Automatic Electric Despatch..... 756
Automatic Safety Fender.... 454
Automatic Substitute for the "Hulloa-Girl" 121
Auxiliary Machinery in an Iron-clad..... 292

BAND-SAW, The First..... 914
Basic Slags, Composition of 621
Blackwall Tunnel, Contract for the 305
Blasting, An Amateur's Experience in. ... 146
Blowpipe, A Substitute for the 124
Boiler-House, A Model... 761
Boiler-Plates, Danger of Attaching Fixtures to..... 126
Boston's City-Hall Problem 136
Boston's Rapid Transit Problem. 601
Brooklyn Museum Building Competition... 466
Brooklyn Power Stations..... 603
Buffalo's Railroad Terminals..... ... 303
"Builder, The" Anniversary of..... 916
Building Operations in New York and Chicago..... 916
Bullion Product of Colorado, The. 778
Bursting Oil-Tanks, Danger from.. 126
Buyer's Function, Importance of the 477

CABLES in New York Subways, Good Condition of 757
California Standard of the "Miner's Inch of Water"..... ... 476
Calumet and Hecla Mines, Electric Motors in the..... 756
Canal Boats, Electric Power for Erie 754
Carelessness Regarding Fire..... 767
Car-Wheels, Casting of..... 296
Catalogues, Advantage of Elaboration in... 609
Caustic Soda Production by Electrolysis... 925
Central-Station Management, Bad..... 602
Chain Tests..... 607
Chautauqua's Lack of Sanitation.....133. 611
Chemistry, College Education in... 769
Chesapeake and Delaware Bay Ship-Canal, The Proposed..... 140
Chicago Architecture..... 133
Chicago's Chance for an Art Museum..... 300
Chicago's Sewage Problem..... 141
Child and Female Labor in Mines..... 311
City and South London Railway, Statistics of the..... 123
Coal-Dust Explosions, Safeguards Against. 776
Coal, Fixing Price of by Law..... 926
Coal-Tar Industry, British..... 620
Coke, Improvement of 118
Collars Should be on the Same Journal-Box. 479
Combination-Tools are Advantageous, Where. 130
Combustion in the Production of Light.... 923
Compact Electric-Power Plants..... 122
Concentrating Ore by Magnetic Action.... 121
Conductivity of Copper, Increased..... 455
Continuous Current Dynamos in England, The 124
Continuous Rail, Possibility of Using a.... 469
Copper Refining by Electrolysis... 455
Corrugated Furnaces in Marine Boilers.... 458
Corundum Output, The 313
Cut-Off Saw, New Form of 130

DEEP Coal-Mining in Europe 313
Deflection of the Band-Saw, Prevention of. 459
Designing Metallurgical Plants, Difficulties in Designing..... 475
Diamonds in Idaho 775
Difficulty in Working With Copper Pipe, How to Overcome a.... 763
Disappearance of New Alloys, Sudden.... 476
Drill Holes, Deep Vertical..... 148
Drilling Square Holes a Possibility.... .. 461

Drill Jig, Importance of Ability to Design a 479
Drop Cams of an Ore-Stamp-Mill, Improvement in 460
Dynamos, British Admiralty Tests of 289
Dynamos, Multiplicity of 455

ECONOMICAL Manufacture, Secret of 477
Economic Geology, Progress of 474
Edison's Incandescent Patent Sustained 290, 601
Efficiency of the Electric Railway, Ancient 287
Electrical Development in 1892 600
"Electrical Dictionary," Sloane's 453
Electrical Insurance Inspection 123
Electrical Lecture Course in New York 453
Electrical Units, Names of 122
Electric Annunciator, Improved 288
Electric Cranes, Best Designs of 122
Electric Current, Maximum Demand for 604
Electric Illumination of Floats 755
Electricity by Wind-Power 119
Electricity in Agriculture 603
Electric Kalsomining Machine 757
Electric Light in Curious Competition with Gas 907
Electric Lighting, Character of Present Progress in 907
Electric Lighting, Obstacles to Profitable 603
Electric Motors Non-synchronous 908
Electric Motors, Small-Arms Factory Driven by 762
Electric Railway Boom in Connecticut 757
Electric Lighting, Character of Present Progress in 907
Electric Railway Conductors, Underground Conduit for 122
Electric Railway, Double Trolley System 909
Electric Railway from Baltimore to Washington, Proposed 454
Electric-Railway Mileage 120
Electric Railways, Closed Underground Conduit for 285
Electric Railways, Cost of Operating 120
Electric Railways in Boston, Profits of 908
Electric Railways in St. Louis 122
Electric Search-Light on Mount Washington 910
Electric Storms, Intensity of 908
Electric Street-Lighting, New Departure in 121
Electric Traction, Late Improvements in 910
Electric Traction, Superior Earning-Power of 452
Electric Wiring, Cheap Labor in 452
End Thrust Given to a Spindle by a Milling-Cutter, How to Overcome the 331
Engineering and Architecture 611
Engines for Central Stations, Best 763
"English Cathedrals," Mrs. Van Rensselaer's 612
European Mechanics in America 149
Exhaust Steam, Heating Buildings by 287
Exhibition of the Architectural League 764
Exposed Metal Work, Protection of 128

FARMERS' Telegraph Lines 287
Fire-Damp, LeChatelier's Treatise on 617
Fireproofing, Blunders in 920
Flats, Inferiority of New York 135
Flash-Point of Mineral Oils 623, 770
Flow of Malleable Metals Under Pressure 478

GAS, A Marvelous 772
Gas and Electricity, Relative Cost to Consumers of 754
Gas Company's Fatal Blunder, A 289
Gas Consumption, Growing Rate of Increase in 121
Gas Engines, Cost of Generating Power by 906
Gas Engines, Loud Exhaust of 914
Gas in Future, Function of 288
Generator, New Type of 455
Geological Reports of Queensland 928
Geological Surveying Necessarily Slow 778
Geometry and Engineering 478
Generators in St. Louis' New Power Station 290
German Iron Industry, Growth of 929
Glass Industry in America, Weakness of the 921
Glass, Non-Conducting Properties of 906
Grade Crossings between Electric and Steam Roads 755
Grade Crossings, The Problem of 304
Gravity Battery, Improvement in 119
Greek Architecture in America 765, 919

HARLEM River, Filling in the 141
Harman Folding Bridge, The 467
Hartford's Electric Power Brought Ten Miles 453
Heating by Electricity 758
High Iron Buildings, Danger from Corrosion in 128
High Voltages Unobjectionable 758
High-Pressure Water-Service in Switzerland 123
High Voltage, The Problem of 124
Honolulu's Harbor, Improvements in 306
Horse Railways No Longer Discussed 286
How Holes in a Drill Jig May be Transferred in a Drill Press 332
Hygiene and Demography, Congress of 465

ICE Manufacture 125
Illuminants and Fog 288

Importance of Making the Removal of Material to be cut from Cast-Iron Surfaces the First Operation 478
Incandescent Lamp Carbons, Radiation in. 121
Incandescent Lamp in Coal-Mining, The.. 476
Incandescent Lamp, New Westinghouse... 454
Incandescent Lamps "Blackening of"..... 453
Incandescent Lamp, The Most Advantageous 121
Institute of Architects, Unfortunate Convention of 464
Insulated Wire, Fire- and Water-Proof... 453
Insulation, Fraudulent 603
Insulator, Silk as an 757
Insurance Schedules, Uniform 920
Investigation of Metallic Carbonyles 772
Iron Cinder in Making Red Paint, Utilization of 772
Iron-Matte Smelting 145
Irrigation Canals, Flynn's Work on 471
"It Goes Everywhere" 950

JAPANESE Electrical Literature 602
Japan Kettles, Protection Against Fire from. 126
Jointless Rails Not Affected by Temperature 455

LARGE Central Station in Pittsburg 453
Largest Warship Afloat, The 307
Lead-Bath Process of Gold and Silver Extraction 929
Létang, Death of Prof 614
Letter-Box, Automatic 756
Lightning and the Trolley 602
Lightning Discharges, Direction of 910
Lightship Lighted by Electricity 455
Liverpool's Overhead Railway 285
Load on the Generators, Automatic Regulation of 454
Long-Distance Electrical Transmission 287
Long-Distance Telephone between Boston and Chicago 907
Long-Distance Telephony, Emergency Cables in 909
Long-Distance Telephony Prosperous 757
Lubrication, A Danish Method of 129

MACHINE-Building, Easy Outlook for 759
Machine-Guns, Garland Rapid-Firing 913
Machinery Exports to Africa 913
Machinery in Shops, Location of 759
Magnetic Field, Photographing the 120
Magnetism and the Human Organism 602
Management, Responsibilities of 149
Manufacture of Caustic Soda by Electrolysis 771
Mechanical Dogmatism Illustrated 332
Mechanical Pump for Exhausting Lamp-Bulbs 756
Medieval Plagues and Architecture 131
Mesabi Iron Ore 774
Metal- and Wood-Work, Analogies in 130
Metalliferous Veins, Chemical Action on .. 308
Metalliferous Veins, Relation of Depth to Richness in 308
Milwaukee Fire, Beneficial Results of the .. 465
Mining, Advantages of Electricity in 909
Mining Adits, Driving Long 146
Mining-Claims Law, Needed Amendments of the 472
Mining Damaged by Speculation 144
Mining Exchanges 144
Mining Experts, Worthless Work of 930
Mining, Ignorance Regarding 776
Mining, Line of Least Resistance in 309
Mining Shareholders, Rights of 774
Mining Students, Increasing Number of ... 312
Mining, Wasteful Methods of 144
Mississippi Problem Not Solved 950
Molders, Diminishing Number of Skilled .. 295
Molecular Effect of Cutting-Tools on Metal 291
Montmorency Falls, Purchase of 757
Motor-Generator, A New 119
Motors for Separate Machines, Advantage of Special 606
Movable Sidewalks and Stairways 127
Multiphase Currents for Long-Distance Transmission 290
Multiple Engine, Advantages of the. 457
Museum-Building, A Model 766

NAPHTHALENE, The Production of Pure ... 921
National Mining-Accident Commission, No Need of a 615
Natural-Gas Supplies Exhaustible 930
Nature Has Helped the Miner, How 309
New England's Wasted Water Power 602
New England's Waterfalls, Harnessing ... 757
New York's Columbian Electric Display a Failure 456
New York's Subways 754
Nickel Steel for Armor 142
Nitrogen Compounds from the Air, Possible Production of 122
North River Tunnel, Progress of the 306

OFFICE Buildings in Far Western Cities ... 462
Oil-Engine in Launches, Advantages of the 296
Orthography, Chemical 620
Over-Supply of Labor Universal 331
Overhead Electric Railway in Liverpool 907
Overhead Wires and Fires 907

PACINOTTI, the Inventor 288
Patents, Telephone, Expiration of 908
Peg Switchboard, Growing Use of 119
Petroleum as a Fuel for the Navy 771
Petroleum Tanks, Proposed Dikes Around 147
Phosphates of Tunis and Algeria 622
Photo-Electric Cells 922
Photo-Engraving, Electricity in 758
Pig-Iron in New Zealand, Bounty for 148
Pipe-Coatings, Protective 773

Placer Mine Debris, Disposal of..... 778
Planer and Slotting-Machine Combined... 130
Pneumatic-Despatch Systems, Inadequacy of..... 604
Poor in Russia, Housing of the..... 302
Power Lost in Engines by Friction..... 915
Private Trolley Line, A Manufacturing Company's 453
Profit-Sharing in Telegraphy, Advisability of 452
Projectiles, Increasing the Effect of..... 913
Propeller-Blades for Steamships, Narrower. 605
Proximity of Electric-Power Circuits to Telephone Lines, Methods of Preventing Danger from..... 289
Pulsating Electric Rock-Drill, New..... 460

QUARRYMEN and Miners..... 314
Quicksand, New Method of Dealing with.. 476

RAILS from Electric Motors, Injury to.... 286
Railway Accidents, The Philosophy of..... 285
Railway Car Heating, New System of..... 762
Railway Car Heating, A Question of Patents 912
Reading a Form of Labor Saving..... 479
Real Estate Boom in Chicago..... 767
Real Estate Dealers' Congress..... 299
Rolls Driven at Needlessly Low Speed.... 312

SAFETY-LAMPS, Merits of the Different... 475
Sanitary Institute, Congress of the..... 299
Schiller Theater in Chicago, The..... 297
Screw-Propellers, Limits of Improvement in 605
Secret or Patented Processes, Which?.... 152
Sewage, Mechanical Devices for Disposal of 460
Shaft Sinking, Doubtful Scheme for Rapid. 310
Shakspere's Ignorance of Mechanics..... 151
Ship-Building in England and the United States, Dwindling Disparity in Cost of.. 459
Shop Solved Problems, Scientific Re-Solution of..... 151
Siemens, Dr. Werner..... 755
Sight-Feed Lubrication..... 129
Silver-Mining, Misstatements About..... 474
Single Cylinder, Disadvantages of the..... 457
Skating Rink of Artificial Ice..... 914
Skidding of Railway Car Wheels..... 911
Sky-Advertising by Electricity..... 456
Sliding Surfaces, Economy in Scraping.... 760
Small Motors, High Pressure Practicable.. 604
Solidifying Petroleum, Clenhall Method of. 144
Speculation in Mining Stocks..... 143
Speed-Control in Street-Railway Motors, Methods of..... 280
Standard in Electric-Lamp Calculations, Need of a 122
Standard of Building, Power of Insurance Companies to Maintain..... 610
Standard Ohm, Accuracy of the..... 123
Steam Engineering, Slow and Sure Progress in..... 760
Steam-Power, Cost of Producing..... 292
Steam-Railway Mileage, Possible Decrease of 120
Steel Plates of Large Proportions..... 130
St. Luke's Hospital Buildings, Plans for the 134
Storage Batteries, Adverse Report on..... 755
Storage Batteries, New York Second Avenue Line to Try..... 453
Storage-Battery Lighting in Germany 456
Storage-Battery Failures..... 123
Street Sprinkling by Electricity 456
Subdivided Power in Shops, Expediency of. 291
Submarine Cables, Induction in..... 909
Survey of St. Louis, the Recent..... 471
Swing-Bridges, Systems of Turning..... 294
Switchboard, An Enormous 122

TAR as Fuel..... 620
Tariff Changes Inadvisable, Sudden..... 473
Technical Training for Mining Work..... 312
Telautograph, Prof. Gray's..... 757
Telephone Exchange, Chicago's Complete.. 910
Telephone Service from New York to Chicago..... 452
Telephone, Train Service Conducted by... 755
Telephonic Coincidence, A..... 455
Terminology of Metals..... 775
Theater-Building, Disregard of Safety in .. 137
Theater Buildings, Proposed Isolation of.. 466
Theatrical Architecture, Improvements in.. 613
Three Thousand Lamps in One Factory... 758
Thrust-Collars on Machine-Spindles..... 149
Titles in Engineering..... 311
Tools, Importance of the Selection of 477
Tribute to an Engineer..... 293
Trolley in Bremen, The..... 454
Trolley Lines Under Elevated Roads..... 919
Trolley, Proposed Legislation Against the. 906
Trolley, Silly Clamor Against the..... 754
Trolley-Wheel for Cutting Away Sleet 758
Tunneling Rock, Saunders Method of,..... 145
Tunnel Left Unfinished, A German 305
Two Levers Unnecessary on an Electric Car..... 758

UNDERGROUND Haulage in Metal Mining.. 310
Underground Wires in New York Satisfactory..... 906

VEINS, "True Fissure"..... 927

WASHINGTON'S Electric Display for the Grand Army 289
Water Gas, Selection of Anthracites for.... 622
Water-Power for Mining, Utilization of.... 616
Water-Supply, Relation of Sanitation to... 137
Weights, Our Confused System of..... 927
Westinghouse Brake, Improvement in..... 756
Wire Glass..... 609
Wood-Working Machinery, South American Market for..... 759
Workman Instead of Architect..... 918
World's Congress of Architects, The..... 300
World's Fair Architecture, Unworthy Criticism of 298
World's Fair, Electrical Transportation Appliances at the 606
World's Fair Exhibitors, Dispute with..... 914
World's Fair, Illuminated Fountains at the 603
World's Fair, Immense Traveling Crane at 914
World's Fair, Incandescent Lamps at the.. 289
World's Fair, Large Dynamos at the..... 120
World's Fair, Large Transfer-Table at the. 757
World's Fair, Number of Lamps at the.... 604
World's Fair, Official Architecture at the.. 613
World's Fair Should Not be Closed at Night 910
World's Fair, Sliding Railway at the..... 138
Worm Gear, Power Lost by the Use of the. 151

XYLOLITH..... 761